CLAIMS:

What is claimed is:

1.   A sensor for determining flow rate of a fluid through a volume, comprising:

a thermistor at least partially inserted into the volume; and

5   a sensor circuit adapted to cycle the thermistor between a zero-power mode and a self-

heated mode.

2.   The sensor as recited in claim 1, wherein the sensor circuit comprises a configurable

power controller adapted to cycle the thermistor between a zero-power mode and a self-heated

mode.

10   3.   The sensor as recited in claim 2, wherein the configurable power controller comprises:

a variable resistance; and

a switch in association with the variable resistance, the switch being adapted to cycle the

variable resistance between a first value and a second value, the first value being selected to

operate the thermistor in the zero-power mode and the second value being selected to operate the

15   thermistor in the self-heated mode.

4.   The sensor as recited in claim 3, wherein the thermistor is in series with the variable

resistance between a first side of a power source and a second side of a power source.

5.   The sensor as recited in claim 4, wherein the thermistor is arranged in series with the

variable resistance at the high side of the power source.

20   6.   The sensor as recited in claim 4, wherein the thermistor is arranged in series with the

variable resistance at the low side of the power source.

7.   The sensor as recited in claim 1, further comprising a conversion circuit for use in

measuring the voltage drop across the thermistor.

8.   The sensor as recited in claim 6, wherein the conversion circuit comprises a first channel for measuring the voltage drop across the thermistor when the thermistor is in its zero-power mode and a second channel for measuring the voltage drop across the thermistor when the thermistor is in its self-heated mode.

9.   The sensor as recited in claim 7, wherein each the channel comprises an isolation amplifier.

10.   The sensor as recited in claim 7, wherein the second channel comprises a voltage divider for scaling down the voltage drop across the thermistor.

11.   The sensor as recited in claim 6, wherein the conversion circuit is adapted to convert the voltage drop across the thermistor from logarithmic scale.

12.   The sensor as recited in claim 6, wherein the conversion circuit comprises a micro-controller adapted to convert the voltage drop across the thermistor in the zero-power mode and the voltage drop across the thermistor in the self-heated mode to the flow rate of the fluid through the volume.

13.   The sensor as recited in claim 3, wherein:

        the variable resistance comprises a first fixed resistor in series with a second fixed resistor; and

        the switch comprises a transistor in parallel with the first fixed resistor such that the transistor is operable to bypass the first fixed resistor.

14.   The sensor as recited in claim 2, wherein the configurable power controller comprises a configurable constant current source adapted to cycle the thermistor between a zero-power mode and a self-heated mode.

15.   The sensor as recited in claim 1, wherein the sensor circuit further comprises a reference circuit adapted to store a zero-power voltage as a reference value.

16.   The sensor as recited in claim 15, wherein in the self-heated mode a known pulse of heat is injected into the thermistor for a predetermined period of time.

17.   The sensor as recited in claim 16, wherein the sensor circuit further comprises a comparison circuit that compares the stored reference value with a changing zero-power voltage value associated with the dissipation of the injected known pulse of heat into the flowing fluid.

18.   The sensor as recited in claim 17, wherein the sensor circuit further comprises a timer circuit that measures the time required for the stored reference value to substantially equal the changing zero-power value associated with the dissipating injected pulse of heat.

19.   The sensor as recited in claim 18, wherein the sensor circuit further comprises an offset circuit that adds an offset voltage value to the stored reference value thereby accommodating for variations in the ambient temperature of the flowing fluid.

20.   The sensor as recited in claim 18, further comprising a conversion circuit adapted to convert the stored reference value, the time required to dissipate the known injected pulse of heat into the flowing fluid, and thermal properties of the fluid to the flow rate of the fluid through the volume.

21.   The sensor as recited in claim 2, wherein the configurable power controller comprises a configurable constant voltage source adapted to cycle the thermistor between a zero-power mode and a self-heated mode.

22.   A method of measuring a flow rate of a fluid flowing through a volume, comprising:

setting a thermistor to operate in a zero-power mode;

determining the ambient temperature of the fluid;

setting the thermistor to operate in a self-heated mode;

supplying a known amount of energy to the fluid;

determining the amount of heat absorbed by the fluid; and

determining the flow rate of the fluid utilizing the ambient temperature of the fluid, the

5   amount of heat absorbed by the fluid, and thermal properties of the fluid.

23.   The method as recited in claim 22, wherein determining the ambient temperature of the

fluid, comprises:

measuring the zero-power voltage of thermistor;

converting the zero-power voltage to a resistance value; and

10   converting the resistance value to a temperature value.

24.   The method as recited in claim 22, wherein determining the self-heated temperature of

the thermistor, comprises:

measuring the self-heated voltage of thermistor;

converting the self-heated voltage to a resistance value; and

15   converting the resistance value to a temperature value.

25.   A method of measuring a flow rate of a fluid flowing through a volume, comprising:

setting a thermistor to operate in a self-heated mode;

supplying a known amount of energy to the fluid;

determining the amount of heat absorbed by the fluid;

20   setting the thermistor to operate in a zero-power mode;

determining the ambient temperature of the fluid; and

determining the flow rate of the fluid utilizing the ambient temperature of the fluid, the

amount of heat absorbed by the fluid, and thermal properties of the fluid.

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26.   The method as recited in claim 25, wherein determining the ambient temperature of the fluid, comprises:

measuring the zero-power voltage of thermistor;

converting the zero-power voltage to a resistance value; and

5   converting the resistance value to a temperature value.

27.   The method as recited in claim 25, wherein determining the self-heated temperature of the thermistor, comprises:

measuring the self-heated voltage of thermistor;

converting the self-heated voltage to a resistance value; and

10   converting the resistance value to a temperature value.

28.   A method of measuring a flow rate of a fluid flowing through a volume, comprising:

setting a thermistor to operate in a zero-power mode;

storing a resultant zero-power voltage as a reference value;

setting the thermistor to operate in a self-heated mode for a predetermined period of time

15 thereby injecting a known pulse of heat into the thermistor;

setting the thermistor to operate in a zero-power mode thereby allowing the injected

known pulse of heat to dissipate into the flowing fluid;

comparing the stored reference value with a changing zero-power voltage value

associated with the dissipating injected pulse of heat;

20   measuring the time required for the stored reference value to substantially equal the

changing zero-power value associated with the dissipating injected pulse of heat;

determining the ambient temperature of the fluid utilizing the stored reference value; and

determining the flow rate of the fluid utilizing the ambient temperature of the fluid, the time required to dissipate the known injected pulse of heat into the flowing fluid, and thermal properties of the fluid.

29.   The method as recited in claim 28, further comprising adding an offset voltage value to the stored reference value thereby accommodating for variations in the ambient temperature of the flowing fluid.

30.   The method as recited in claim 28, wherein determining the ambient temperature of the fluid utilizing the stored reference value, comprises:

        measuring the zero-power voltage of thermistor;

        converting the zero-power voltage to a resistance value; and

        converting the resistance value to a temperature value.